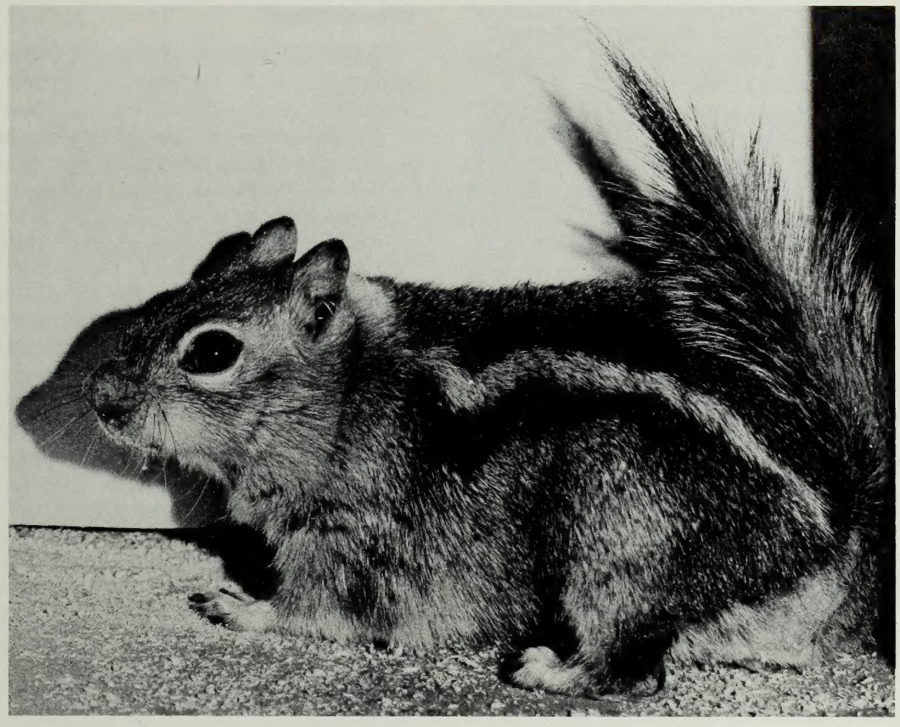
MCZ newsletter
MUSEUM OF COMPARATIVE ZOOLOGY

Harvard University
Cambridge, Massachusetts
Volume 6, Number 2
Winter, 1977

Philip J. Darlington, Jr.



Golden mantled ground squirrel, awake . . .

and hibernating. All extremities are tightly curled under the body.

HIBERNATION, ANYONE?

The winter of 1977 is enough to make the always somewhat intriguing idea of hibernation seem positively seductive! How clever are those animals who manage to avoid all the storms safe and oblivious in their nests and burrows. Just how they manage it is a question that has occupied Dr. Charles P. Lyman, recently promoted to Professor of Biology and Curator of Mammals in the MCZ, for the last thirty years.

Fortunately for the layman, Dr. Lyman's long list of publications (to which he is currently in the process of adding a book in collaboration with cell physiologist John Steele Willis) include several popular articles.[1] Here are the answers to some basic questions on hibernation, mostly in Dr. Lyman's words.

What is hibernation?

"Webster defines hibernation as passing the winter in a torpid or lethargic state. If the phrase *true hibernation* is used for a lowering of body temperature, this implies that any other type of hibernation is false. Therefore, we have coined the phrase *deep hibernation*. I define deep hibernation as a passive abandonment of the warm-blooded state, with body temperature reduced to a few degrees above the environment, but with the animal retaining the ability to rewarm without heat from external resources."

Who hibernates?

"At least five of the eighteen living orders of mammals contain species which hibernate. Small opossum-

1. For further reading see McGraw-Hill Encyclopedia of Science and Technology, 1977.

like marsupials, both from South America and Australia, have recently been shown to be hibernators. Among the Insectivora the European hedgehog is the best known hibernator, but the tenrecs of Madagascar also hibernate. In the Primates there are at least two lemurs which are reported to hibernate, and most of the bats (Chiroptera) of the temperate regions hibernate throughout the winter. It is among the rodents that the largest number of hibernators is found. Dormice, ground squirrels, birchmice, chipmunks, and woodchucks are among the best known hibernators from this group . . . Folklore to the contrary, bears do not enter the deeply hibernating state. They often retire to dens during the winter and remain curled in a ball for long periods, but Hock and other scientists have shown that their body temperature does not drop below 91°F., and they are ready to wake up at once and amble drowsily away (Hock, 1957).

Why hibernate?

There is a simple answer to this question: economy. For, as Dr. Lyman explains, it is a costly metabolic proposition to maintain a body temperature of close to 100°F.

> "Many years ago Claude Bernard pointed out that mammals as a class had developed an extremely precise control over their internal environment, and hence were less influenced by the vagaries of the external environment than were more primitive vertebrates such as reptiles or amphibians. To a certain degree, they carried their own weather around inside them and hence they could live in places which would chill, sizzle, dessicate or waterlog an animal with less internal environmental control. One of the most important additions to this physiological advance was the development of "warmbloodedness", which has been attained, of course, only by mammals and birds. Actually "warmblooded" is itself a poor word, for a reptile can be warmblooded if it sits in the sun. A better word is "homeothermic", which indicates that the body temperature remains steady.
>
> A body temperature of near 100°F is really quite hot, and it has been said that 'mammals live internally in the tropics'. There has been much speculation concerning the reasons for this high temperature, for it actually means that mammals and birds use an enormous amount of fuel to keep themselves warm. Most mammals carry this metabolic millstone with them throughout their lives — they must hold their temperature above 90°F or die in the attempt.
>
> The hibernators, however, have developed a dodge which was universal among their reptilian ancestors. Under certain very specific circumstances they abandon the warmblooded state and allow their body temperature to drop to that of the environment. From the point of view of metabolic economy, the mammal which hibernates saves at most as much energy as the reptile or amphibian but here the resemblance stops.

Hibernation is a particularly effective strategy for small mammals since, having the highest body surface area to body mass ratio, their metabolic load is the heaviest.

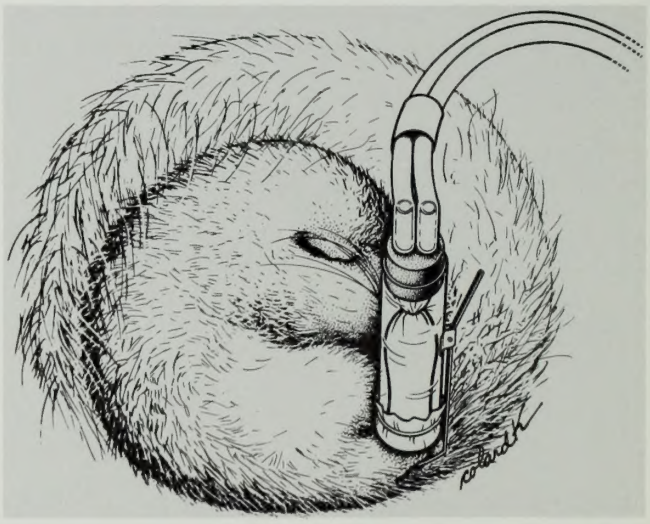
How does the researcher study hibernation?

With difficulty! As Dr. Lyman puts it:

> "Until recently the physiological changes which take place during a bout of hibernation had not been measured because of the lack of instrumentation. Unlike most physiological studies where the experimenter can produce the condition he wishes to study at will, there is no known way of producing hibernation. The investigator must design his apparatus so that the animal is in natural comfort, and then hope that the recording machines do not break down until the necessary information has been obtained. Chronically implanted thermocouples and skin electrodes for recording heart rate and electromyograms are now routine . . . Always the investigator is faced with the problems of dealing

Photos by Alfred Ley

Edible dormouse in hibernating position; note exposed hind feet.



This drawing shows an experiment to determine whether the waking process in the edible dormouse is stimulated by peripheral temperature. The pair of "boots" or "Wellingtons" serve to circulate liquid around the hind feet and can vary their temperature while T_B (Body temperature) is held constant. When T_W (Wellington temperature) was lowered, heart rate, respiratory rate and oxygen consumption increased.

with a small, wild animal which may object so strenuously to a piece of apparatus that it will never hibernate. Some species are temperamentally unfit for laboratory experiments, and have to be abandoned after many frustrations. Thus it is no wonder that the information accumulates but slowly, and that comparative data for various species are far from complete."

How does hibernation work? (including as many questions as answers)

The many physiological experiments conducted by researchers into every aspect of hibernation have produced many answers to this puzzling process but many questions remain.

It is known from simple observation, for instance, that there are two kinds of hibernators (those that store large quantities of food in their nests like the chipmunk and those that store food internally like the woodchuck) and that at a certain time of year these animals begin preparing for hibernation. It is not known, however, what stimulates them to start preparing.

> "Whatever the preparation may be, one day or night the animal starts to hibernate. At that point his oxygen consumption, respiratory rate and heart rate start to drop, and only after this does his body temperature begin to go down. This is in marked contrast to the amphibian, reptile or the non-hibernating mammal when exposed to overpowering cold. In such cases the body temperature falls first and the heart rate and other vital functions decline as a consequence. Entering hibernation may well be an active process, in which the heat regulating mechanisms are deliberately dampened so that body temperature declines passively to that of the environment."

It is also known that all hibernating animals rouse themselves periodically:

> "This process of arousal is the most dramatic phase of the hibernating cycle, for it starts with an inert, moribund animal and ends three or more hours later with a beast which is totally awake, very active and extremely angry. Fortunately, the whole process may be easily studied because all one has to do is to stimulate a hibernator with a poke or a pinch, and the animal does the rest. During arousal the animal warms itself more than 50°F and the metabolic effort required to do this is enormous. When a woodchuck is puffing away trying to get his temperature back to 'normal' he is using more oxygen than when he is running full tilt across a field."

Obviously, arousal is a very expensive habit, in terms of energy consumption, but just why the animal needs to indulge in it (in some cases as often as once a week) has not been adequately explained.

Professor Charles P. Lyman, awake.

The exact sequence of body warming upon arousal has also been thoroughly documented:

> "The process of arousal is beautifully coordinated, for the blood is shunted from the rear end of the body so that the front end warms rapidly while the rear remains cool. At one point in arousal there can be at least a 40°F difference in temperature between the heart and the lower abdomen. This is a very efficient way of doing things, for the most important organs — heart, lungs and brain — are first to reach their peak efficiency, and heat loss during warming is kept at a minimum by only warming one area at a time. Once the anterior has reached about 95°F vasodilation occurs, and the warm blood rushes to the posterior."

What is the outlook for human hibernation?

Quite apart from the prospect of fulfilling some of our escapist midwinter fantasies, hibernation for humans is an integral part of any serious space travel consideration:

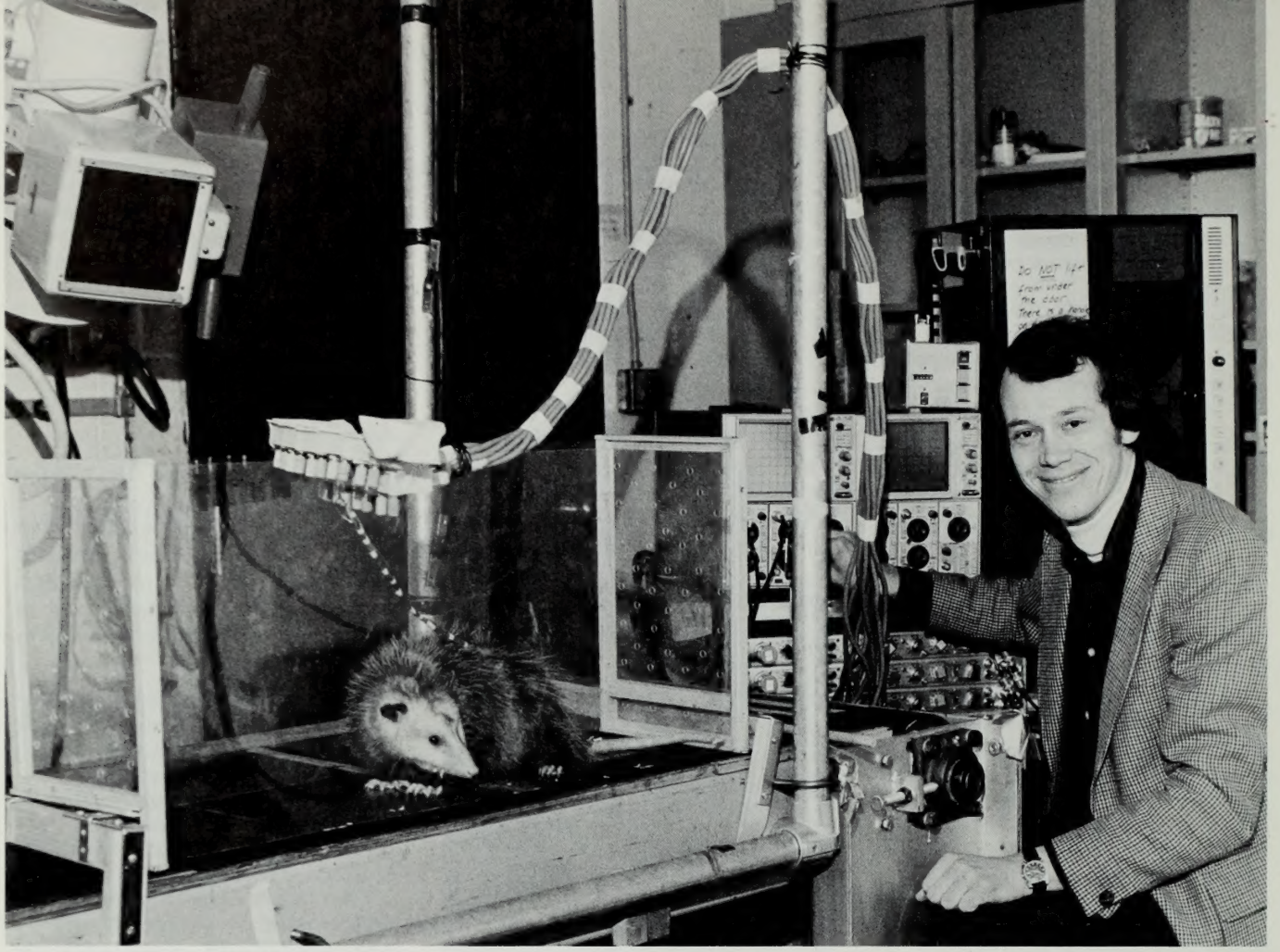
> "Fortunately or unfortunately, most space travel tourist-spots are a long way off, and there is not much merit in starting off as a high school student and landing as an octogenarian, having spent one's life in a capsule. We think that the process of aging is greatly reduced during hibernation, so that if we can induce hibernation in humans the far off planets had better watch out. However, I suspect that inducing hibernation in humans will be a lot harder than getting them into space."

Hibernating animals, far from being more "primitive", i.e., closer in their physiological process to reptiles than are other mammals, as was once thought, are actually more highly developed since they are able to sustain life at two distinct temperature settings. A large number of researchers, who are about to hold their Fifth Symposium on Hibernation, are sparing no effort to find out their secret formula.

NEW EDITOR

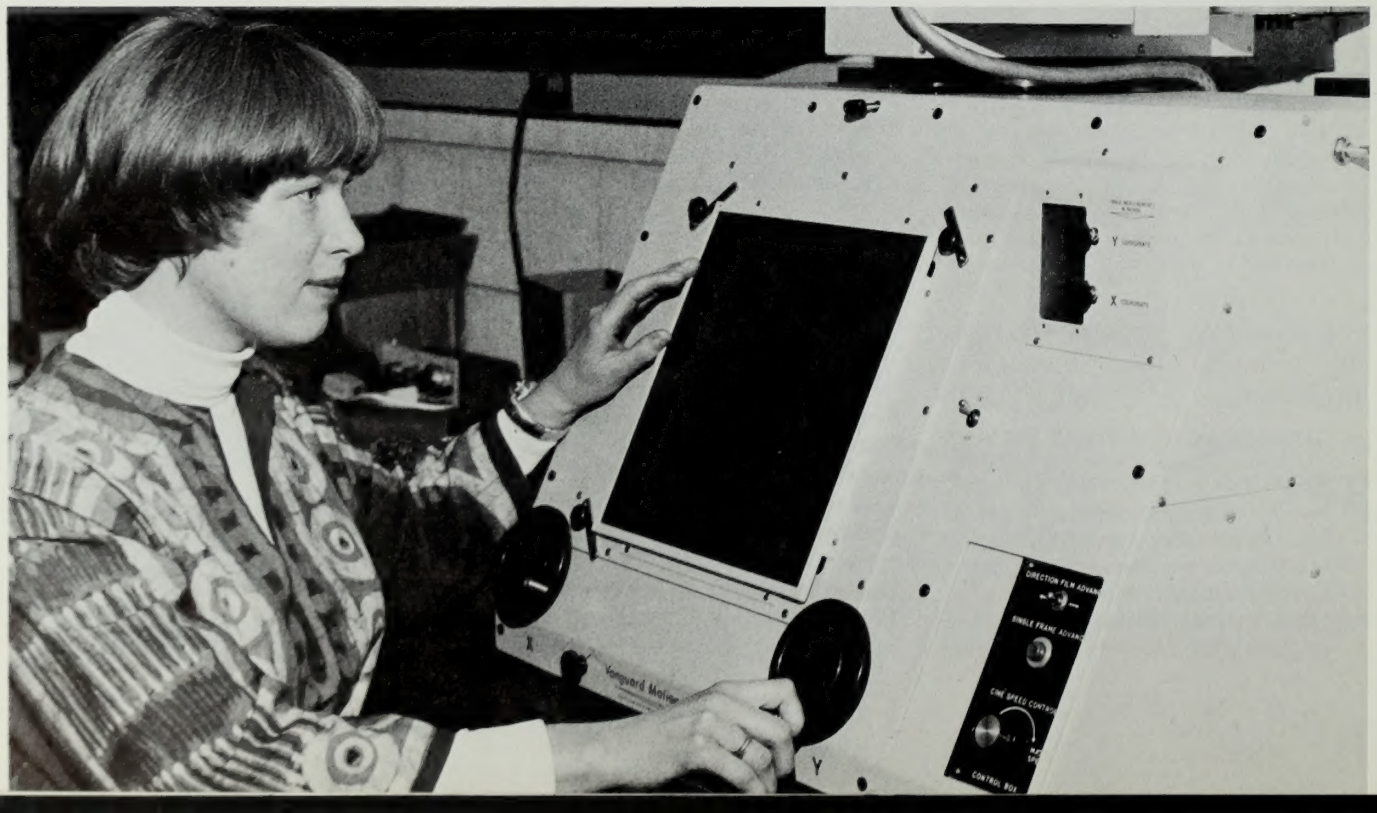
Dwight Davis has joined the staff as Editor of the MCZ's two scientific publications, *Breviora* and *MCZ Bulletin*. To find him, authors should go to the back of the Mammal Department on the fifth floor.

Mr. Davis, who majored in Biology at Macalester College and is completing his M.S. in Journalism (Science Communication) at Boston University, welcomes this opportunity to immerse himself in biological writing and to become familiar with publication procedures. He is working on increasing circulation and will soon have a new brochure ready for mailing.



VISITORS *This complicated-looking set-up allows Dr. Wilhelmus A. Weijs (a visiting functional anatomist from Groningen University, the Netherlands) to simultaneously x-ray (upper left) and record the muscle activity (through cable to electromyography equipment at right) during locomotion of the American opossum. To date, no foolproof technique has been developed to guarantee locomotion to coincide with the experimental schedule!*

Dr. Jalka Weijs-Boot, also visiting for a year from the Netherlands, is assisting Professor A. W. Crompton in his ongoing study of mastication by analyzing high-speed film on the Vanguard motion picture analyzer.



THE MORE WE KNOW . . .

It is a common experience to find that the answer to one difficult question only leads to a whole set of even more difficult questions. Professor Richard C. Lewontin's research into genetic variation in populations is no exception.

Until 1966, there was no way to measure how much genetic variation existed in a particular population. Ernst Mayr, in a 1963 review of the state of knowledge, concluded:

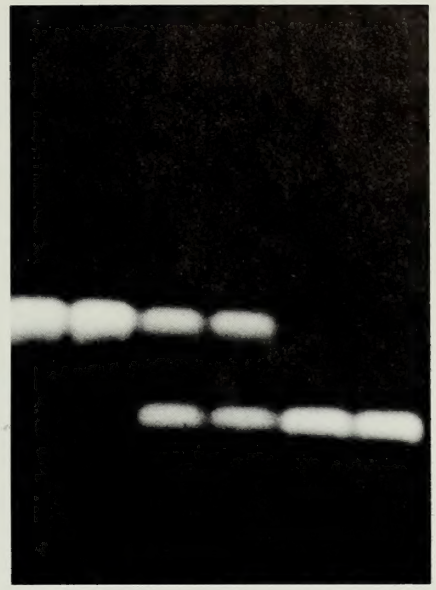
> "It has been estimated (Wallace, 1958) that 50 percent or more of the loci of a given individual in an open natural population may be occupied by dissimilar alleles.[1] Others calculate that 12-20 variable loci already place a severe strain on a population, owing to the segregation of inferior genotypes. Far more research and a classification of the basic concepts is needed to narrow the gap between these widely divergent estimates."

The technique of gel electrophoresis (see photo) developed in 1966 by J. L. Hubby and Richard C. Lewontin, then at the University of Chicago, was the breakthrough needed to allow researchers to measure the amount of genetic variation within a population and since then, researchers the world over have been grinding up all kinds of organisms and separating the proteins by subjecting them to an electric charge. Answers to the resulting new set of questions are now being sought by the population genetics group at the MCZ. They are trying to find out what the surprising results mean. Why is there such an unexpectedly large variation between individuals of the same species?

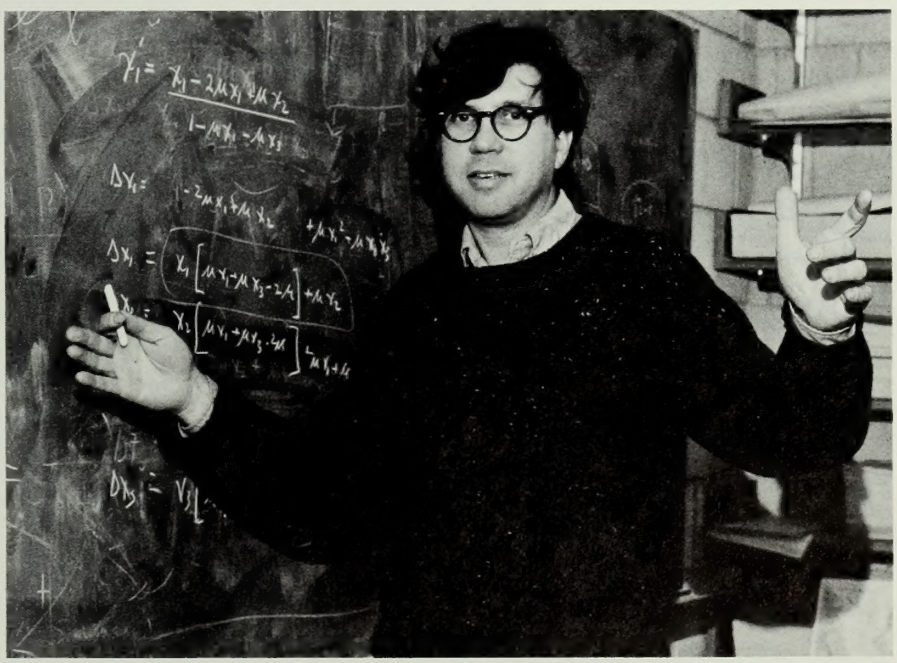
"Perhaps we're not as interesting to the layman as other MCZ departments because we don't study easily seen characteristics of appealing, or at least interesting, animals," explains Dr. Lewontin but obviously, the research they conduct in the population genetics department is at the base of all evolutionary studies. Their research animals, *Drosophila* or fruitflies, are eminently practical for several reasons: 1) they reproduce conveniently fast, going from one generation to the next in seven to ten days; 2) their characteristics are very well known having been thoroughly studied by geneticists for many years; and 3) they don't bite!

An active population of students is attacking the problem from various angles. Don Hickey is trying to assess the role that enzymes play in genetic variation; Fred Cohen is looking at genetic variation in waterfleas; Jerry Coyne and Alex Felton are concentrating on hidden genetic variability while Anand Gupta is questioning the morphological consequences of genetic differences. John Ramshaw, an Australian biochemist who will soon be joining the staff, will undertake the difficult task of analyzing the proteins themselves on the biochemical level.

Meanwhile, Professor Lewontin is finding time to teach five courses this year ranging from Biology 106: Social Issues in Biology to Biology 153: Biological Statistics. Although his lectures are always masterfully organized, none of his students have ever seen him sit down to write a lecture. Friends of the MCZ will have an opportunity to hear Professor Lewontin speak on "Genetic Diversity in Humans and Other Animals" on Tuesday, May 10, 1977.



A gel showing genetic variation of the amylase enzyme in Drosophila. *The first two bands from the left are one form of the enzyme, the two bands on the right are a slower-moving form, and the middle two are heterozygotes, having both forms of the enzyme.*



Professor Richard C. Lewontin

1. Mendelian genetic characteristics.

The MCZ Newsletter is published three times a year by the Museum of Comparative Zoology, Harvard University, Oxford Street, Cambridge, Massachusetts 02138; A. W. Crompton, Director.
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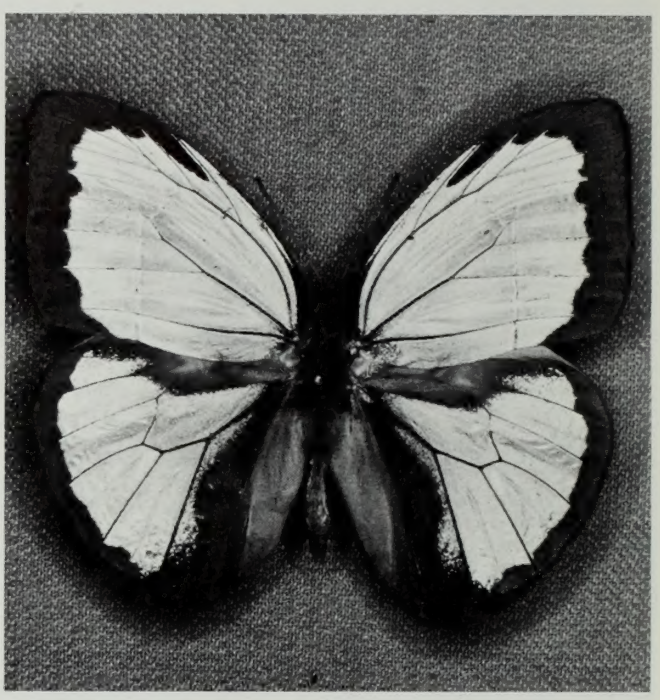
Paula Chandoha

IN BUTTERFLIES, BEAUTY IS MORE THAN SKIN-DEEP

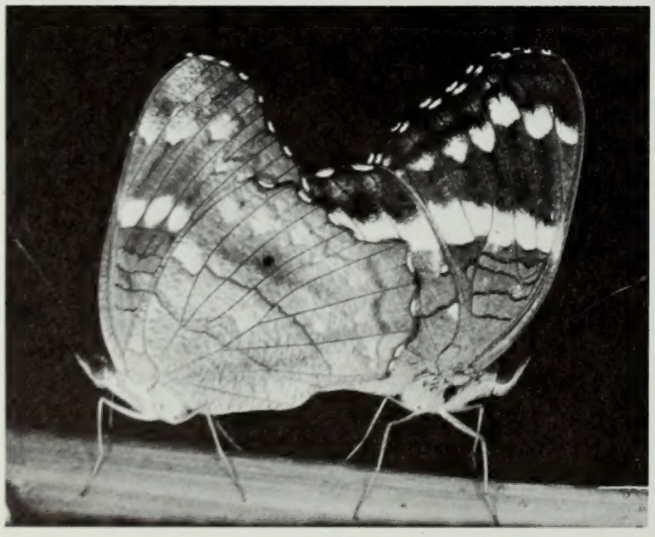
a



b

How insects recognize one another is one of the questions being studied by Dr. Robert E. Silberglied, Assistant Professor of Biology. For example, many butterfly species have "hidden" ultraviolet patterns on their wings, which they can see but to which we are blind. A common orange butterfly of the New World Tropics, as we see it *a*, contains a "hidden" ultraviolet component *b*, visible only to the insects (as a color pattern superimposed upon the image we see). Butterflies have the broadest visual spectra known in the animal kingdom.

During the spring and summer, Dr. Silberglied works with the living butterflies on Barro Colorado Island, Panama, where he is affiliated with the Smithsonian Tropical Research Institute. By hybridizing different species of butterflies (mated pair composed of different species *c*) and rearing the offspring, he and his collaborator Annette Aiello are able to experimentally determine how their wing patterns *d* and mating preferences are inherited. By studying differences in mating preferences between populations, and by physically, chemically and genetically altering the color patterns on their wings, much can be learned about how such behavior and color patterns evolve. Photos by Robert E. Silberglied



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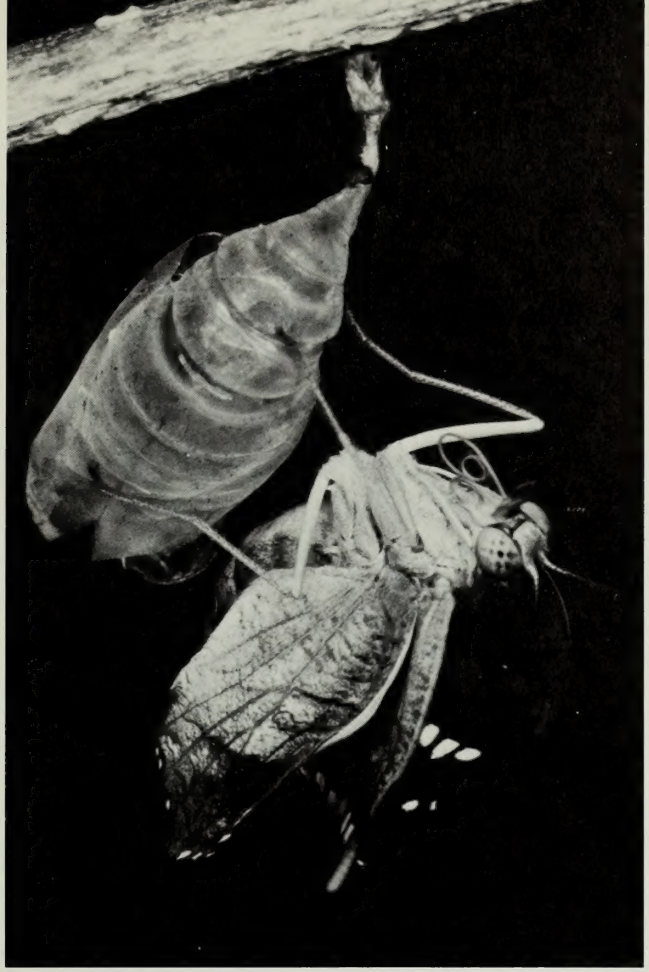
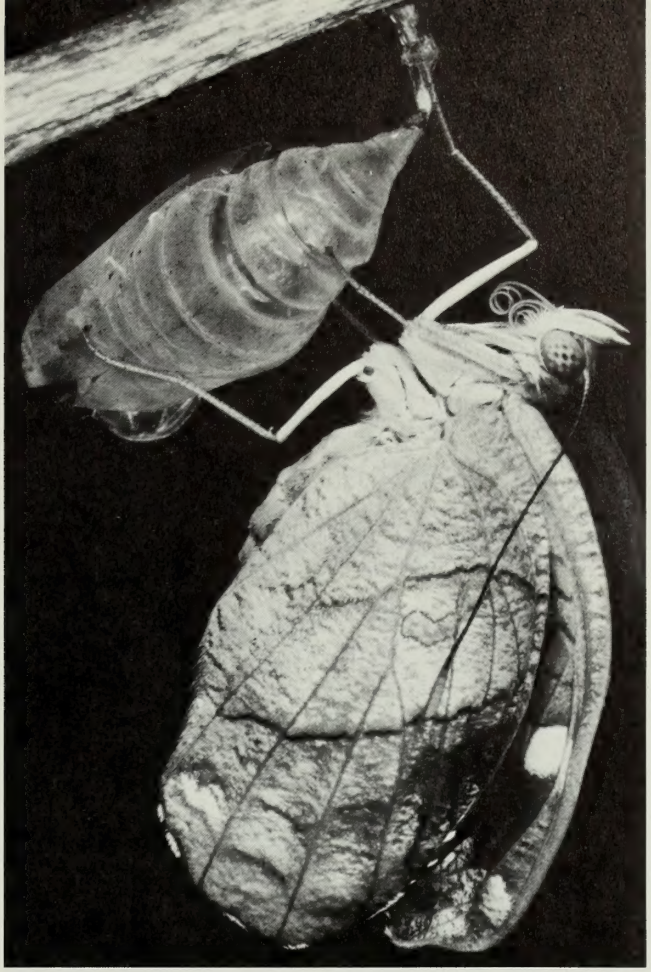
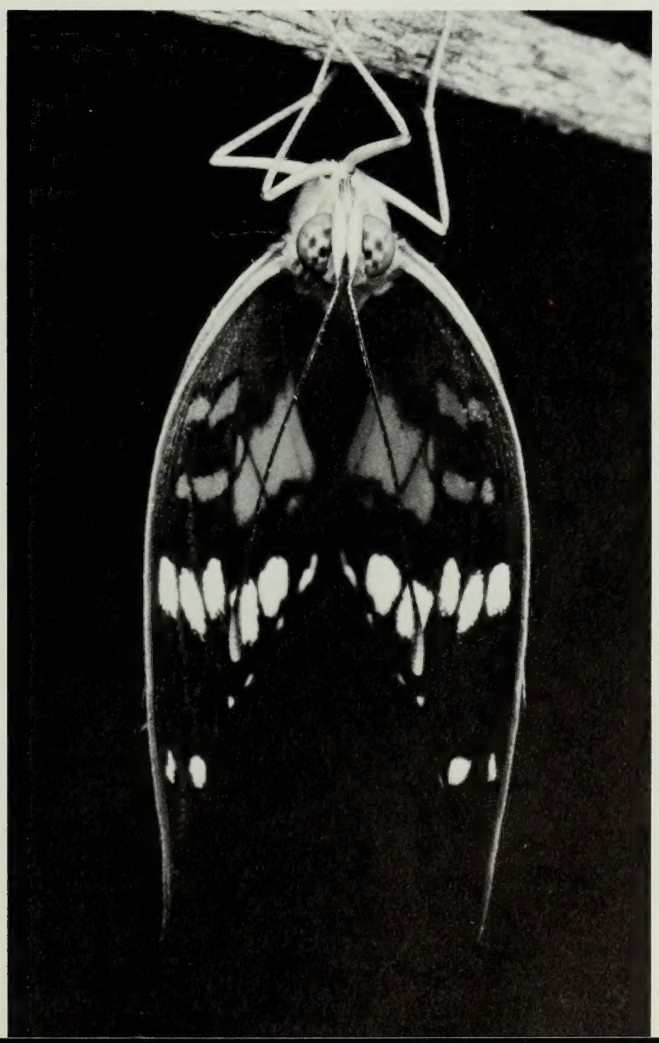




This sequence shows an offspring eclosing from its pupa and extending its wings.



GONE FISHING
in the MCZ

A visit to the MCZ's Fish Department these days is a stimulating experience. From the collection area, where Curatorial Associates Robert Schoknecht and Karsten Hartel oversee the actively used bottled specimens in their splendidly renovated quarters to the experimental labs where Professor Karel F. Liem and his students leave few questions unasked about their chosen animals, exotic specimens of which can be viewed swimming in their aquaria, there is an undeniable aura of intellectual excitement in the air (and water!). The visitor seldom finds everyone at home since various members of the Department are often at sea (or river or lake) collecting new specimens to help solve the many mysteries of aquatic life. On a recent venture into the Department, this visitor found Assistant Professor William Fink[1] newly returned from Brazil with a catch of *Synbranchus marmoratus* for Professor Liem's research into air-breathing adaptations, while graduate student Philip Lobel, having temporarily suspended his coral reef collecting and study of feeding distribution in the Pacific, was in Panama working on fish ecology. Professor Liem, who is teaching two courses this Spring (Biology of Fishes and, together with Professor Farish A. Jenkins, Jr., Functional Vertebrate Morphology) was on hand to explain his current work as were graduate students Joe Levine, George Lauder, Dana Ono, and Dr. James Wallace.

Professor Liem is simultaneously involved with three somewhat inconoclastic lines of inquiry. First, he is questioning the hypothesis that adaptations are always the most efficient solution to a particular problem of survival by investigating the air-breathing mechanisms in some fishes who have developed this adaptation as, what seems to be, a compromise. These fishes use the same structures to both eat and breathe and while they gain mobility and are able to inhabit habitats not available to non-airbreathers, they are not able to exploit all the food sources in these habitats due to the limitations imposed by their compromise solution.

A second area of study deals with the concept of optimization, using the exceptional case of the cichlids, a group of freshwater fishes which display a remarkable variety of adaptation in their feeding mechanisms. One of the reasons they are able to exploit every available food source with such efficiency is that their feeding mechanisms, unlike that of the airbreathers, is independent of other functions and they can therefore evolve optimal solutions to a great variety of problems.

The study of variations both at the individual and population level has led Dr. Liem to his third major area of current work, a general critique of predictive models in functional anatomy. He is skeptical of the current preoccupation with developing models to explain and predict the evolution of organisms and is concerned that investigators are returning to the "body plan" concept of the idealistic morphologists. The danger is that the model can become more important than the real organism. Having built a model to explain the muscle mechanisms in cichlids, Dr. Liem then realized that the remarkable capability of cichlid species to deviate from that model is probably much

1. See *MCZ Newsletter* Fall, 1976, Vol. 6, No. 1.

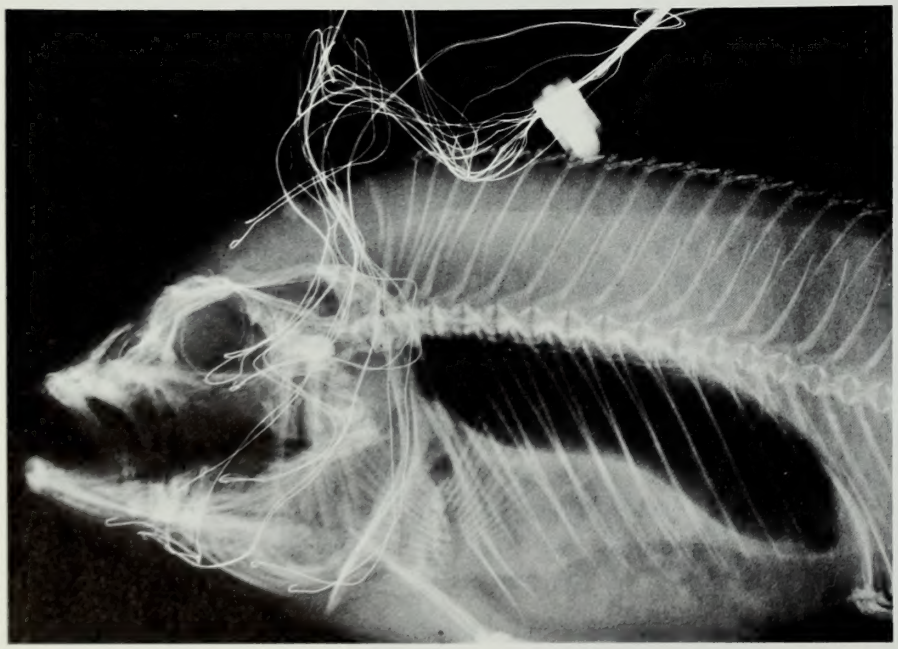


Photo by William M. Winn

Karel F. Liem, Henry Bryant Bigelow Professor of Ichthyology.

Cichlid fish from Lake Malawi with electrodes in the various jaw muscles to record muscle activity during feeding on an electromyogram.

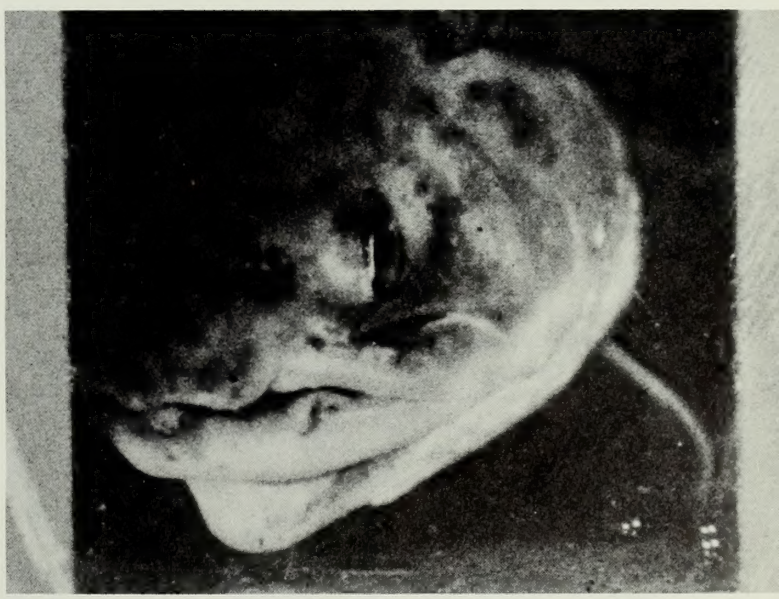
more important and could be the key to their evolutionary success. For example, what does a cichlid do during the two months of the year when its preferred food supply is diminished? Its ability to deviate from its normal feeding behavior allows it to survive. The remarkable diversity of cichlids may have a genetic basis — four kinds of offspring from one set of parents in *Cichlasoma* are adapted to feed on four very different foods, i.e., snails, fish, insect larvae and detritus. Clearly this extreme polymorphic diversity leads one to question the value of trying to average feeding patterns into a particular body plan — perhaps it is the diversity in functional expressions that leads to evolutionary success. Dr. Liem thinks that in the field of functional morphology it is time for the pendulum to swing back to the study of variations which is how Darwin, after all, developed his theory of natural selection.

Dr. Liem's students also display a remarkable diversity.

George Lauder

What is the secret of the remarkable success of ray-finned (teleost) fishes? With over 20,000 species, they are the world's dominant vertebrates. George Lauder is looking for the answers in the feeding mechanisms of their primitive ancestors, both living and fossilized. In a research study that parallels Professors Crompton and Jenkins' work on mammals, Mr. Lauder is making high-speed films (both light and x-ray) of primitive living fishes as well as using electromyography to determine exactly when the muscles of the head are contracting. This allows a detailed comparison to be made between the structural/functional relationships in primitive living fishes and the remains of fossil forms and gives an understanding of how these extinct forms functioned. This work is greatly aided by the MCZ's fine collection of fossil fishes.

X-ray of a fossil fish (Dapedium *sp.*)



This sequence shows the feeding mechanism of a trout in action; before, during, and after ingestion. These frames were taken from a 16mm movie at 200 frames per second.

Joe Levine

The bright colors of coral reef fishes have led Joe Levine to ask whether the fishes see color themselves. He hopes to establish, through behavioral experiments, that they in fact do see colors (by setting up tests and rewarding them with food when they "push" the "right" colored button) but *how* they distinguish between different colors in water is a far more difficult problem. Color vision in air is a relatively simple matter but does the ability to distinguish different frequencies in water, where the spectrum of the illuminating light is much more restricted, require special adaptation? And is it different in shallow and deep water species? Using microspectrophotometric techniques, developed by Dr. Edward F. MacNichol, Jr. of the Marine Biological Laboratories at Woods Hole, Mr. Levine is able to study the absorption spectra of individual cells' visual pigments. There is little known about evolution of color vision, and since there is little data, there is a great deal of conjecture in this area. Mr. Levine is doing some of the very basic data gathering necessary to the development of a valid theory of visual sensitivity in fishes, which in time will allow serious consideration of questions like why some animals see color while others don't.

Dana Ono

You know that your hand is behind your back without having to look at it. The brain is given information about the state of the muscles via muscle receptors which are found lodged in the muscles themselves. There is a system in the human brain which monitors the muscle activity. The same is true in fishes although a different feedback system is required for fishes to be able to monitor muscle contraction in water. Evidence for this is found in the fact that highly specialized receptors known as muscle spindles are found in all groups of vertebrates except fishes. As of yet, no one knows what the receptors in fishes look like or how the feedback system operates in feeding and respiration.

Dana Ono is attempting to isolate the feedback system by which fishes operate by elucidating the nature of the receptors themselves with the use of transmission electron microscopy and other histological methods. With the aid of electromyography which provides data on the exact time of muscle firing, Mr. Ono is trying to determine whether fish have a preprogrammed muscle firing system or whether it can be modulated by outside conditions. Since cichlids adjust their responses constantly, there must be a fairly complex system by which they operate.

Dr. James Wallace

Dr. James Wallace, a radiologist who is a half-time student, is using radiology to investigate feeding mechanisms in trout and salmon. By inserting surgical wire in their bones, Dr. Wallace is able to use x-ray vision to monitor the patterns of the feeding mechanism.

The visitor came away from the Fish Department with renewed interest and respect for the remarkable complexity of the two little goldfish in the office bowl.

FISH DEPARTMENT RECEIVES IMPORTANT COLLECTIONS

New space made available by the recent renovations in the MCZ's Fish Department, and lack of space at the Woods Hole Oceanographic Institution, have led to the transfer of the entire WHOI fish collection to the MCZ.

The first shipment of over 16,000 North Atlantic mid-water fishes has arrived and has been catalogued. Approximately 130 species from 14 families found at depths of about 1,000 meters are involved. Among the more interesting groups: the viper fish *(Chauliodus)* which has modified anterior vertebrae that allow the fish to move its head back on its spine. It can then open its mouth wide enough to get food past its enormous teeth. *Malacosteres*, a fish with a large luminous organ under the eye has greatly enlarged jaws, but its mouth has no floor.

When the transfer of additional surface and bottom material is complete, the MCZ collection will be exceptionally representative of North Atlantic fish fauna.

FRIENDS' ACTIVITIES

Spring Lectures

Professor Karel F. Liem: *Explosive Evolution and Efficiency of the Exploitation of Energy: Cichlid Fish Biology,* Tuesday, April 12, 1977.

Professor Richard C. Lewontin: *Genetic Diversity in Humans and Other Animals,* Tuesday, May 17, 1977.

Drawing Courses

Sarah Landry and Laszlo Meszoly will be teaching *Drawing from Nature* and *Scientific Illustration* this summer. These summer courses (three mornings a week during the month of July) have been extremely popular with students who wish to work intensively on improving their drawing ability. Registration information will be available in April.

Children's Saturday Mornings

In order to meet the demand, two sessions of this program are being held. Plans for a spring series will be announced soon.

Paper Marbling Workshop

How to marble your own paper was the morning's topic on Saturday, March 5 with Mary Keeler of the MCZ Library.

Trip Round-Up

Provincetown whale watching has proven to be a popular occupation. Since last year's weekends were such a success, we have again enlisted the services of William E. Schevill as marine mammal guide and reserved two weekends on Captain Avellar's *Dolphin*

III for this Spring. The dates are May 7, 8 and June 4, 5 and reservations are being accepted on a first-come first-served basis. For more information, call the Public Programs office at 495-2463.

Baja whale watching was superb again this January as reported by Steve Katona:

"Blissfully unaware of the blizzards and subzero temperatures ravaging the rest of the continent, 34 Baja trippers spent a glorious week on the fourth MCZ gray whale expedition.

As in the past, the gray whales put on a terrific show, and we were able to see mating, breaching, spyhopping, mother-calf relations and a good deal of general milling around. Whereas one can count on the gray whales, the rest of the trip always provides surprises, and each year's expedition is different. This year *Qualifier 105* and its skiffs were joined by four bottlenose dolphins *(Tursiops truncatus)* on several occasions in the lagoon. We were able to get good views of the dolphins as they rode our bow and looked up to watch us. Some Pacific white-sided dolphins *(Lagenorhynchus obliquidens)* and many common dolphins *(Delphinus delphis)* were also seen. The sight of groups of up to 50 common dolphins jumping and racing to meet our boat was particularly thrilling. We had excellent opportunities to observe harem structure, mating, nursing, aggressive interactions and other behavior in elephant seals on San Benitos Island. Large colonies of California sea lions along the coast of Cedros Island gave good views of the animals at rest, while swimming and playing behavior were seen in the species on San Benitos Island. The harbor seals on San Martin Island tolerated our observations better than in previous years and we were able to observe and count approximately 150 animals.

Several dying elephant seal yearlings were seen at San Martin, one of which carried about 20 goose-necked barnacles attached to its flippers and back. Photographs and samples of the barnacles have been sent to the MCZ for identification.

Of equal interest to the marine mammals were our observations on other animals and plants. Although 1976 was a dry year in much of California, the islands we visited were quite green and Reed Pierce was able to demonstrate numerous plants in flower. Bill Haas was able to make several new location records for birds, including both a Coopers hawk and a horned grebe on San Benitos Island. The grebe was found dead in an abandoned outhouse at the top of the lighthouse hill on San Benitos! Two unusual Heerman's gulls with symmetrical white wing patches were seen at San Ignacio Lagoon. Other seabirds seen included many Manx shearwaters, pink-footed shearwaters, a black-footed albatross, Sabine's gull, Xantus murrelet, parasitic jaeger, frigate bird and rhinoceros auklet, among others. Explorations of the intertidal zone at Cedros Island turned up three octopuses, abalones, a sea hare, top shells and turban shells, nudibranchs, several colorful sponges, and numerous sea anemones. Bill Haas was active as usual, turning over rocks to find lizards and scorpions, and discussing the geology of the places visited.

Each night (except one very rough evening) featured slide talks by one of the guides or a show-and-tell of the day's events. One special evening included a talk on whale evolution by Frank Whitmore, who is a specialist in the study of fossil whales at the Smithsonian Institution."

Justine Kalb, daughter of the leader of the Rift Valley Research Mission, with the hominid skull found in January.

ETHIOPIAN FOSSIL SITE YIELDS HOMINID SKULL

Here is the exciting sequel to last Spring's account (*MCZ Newsletter*, Vol. 5, No. 3) of Craig Wood's fossil hunting in Ethiopia. Upon their return to the Afar Triangle site, Jon Kalb's Rift Valley Research Mission expectations were fulfilled — a skull of *Homo ?erectus?* (the question marks indicate that the exact identity is still under investigation) was found in the area where numerous stone handaxes had formerly been uncovered.

The skull was found in two parts: one by Alemayehu Asfaw, the representative of the Ethiopian government accompanying the expedition; and the other by Craig Wood and Paul Whitehead, a vertebrate paleontology student from Yale.

Charles Schaff, Curatorial Associate of Vertebrate Paleontology, who also visited Ethiopia on an MCZ reconnaissance trip this fall, missed the hominid excitement but did, together with Messrs. Wood and Kalb, discover the first Mesozoic (100-140 million years old) dinosaur and reptile fossils from the Ethiopian plateau in the spectacular blue Nile region.

A return trip by the Rift Valley Research Mission is planned for continued collection in Miocene to Pleistocene localities of the Afar Desert Region of Ethiopia. Exploration of these areas was facilitated by the Ministries of Culture and Mines.

Photo by Craig Wood

MARCH IS FOSSIL MONTH

March visitors to the Harvard University Museum will have an opportunity to learn first hand how fossils are formed, how they are found and collected, and how scientists study them to learn about the origins of life on earth. Special features include: a new exhibit on stratigraphy, a slide tape showing all aspects of the paleontologist's work narrated by Professor Farish A. Jenkins, Jr., Curator of Vertebrate Paleontology, and two "Fossil Rooms" where visitors will be able to cast their own fossils and learn how and where to find fossils in the field.

David Ebert, Museum Teacher, plays "The Last of the Dinosaurs" with a group of volunteers in preparation for Fossil Month.

Kaki Aldrich, Education Consultant to the Visitor Programs, shows volunteers of two generations how to cast fossils in preparation for Fossil Month.

This "theme month" is the first in a series planned and run by the volunteer Visitor Programs staff, now headed by Kaki Aldrich and Lola Stillman. Their enthusiastic energy is not only infecting both new and "old" volunteers but also enlisting the valuable support of other staff members engaged in both the scientific and public sides of the Museum's activities.

For more information about Fossil Month and the Visitor Programs in general, call Lola Stillman at 495-2341 or 495-2248.

WILLIAM CHARLES SCHROEDER (1895-1977)

William Charles Schroeder, who was Associate Curator of Ichthyology in the MCZ from 1936 to 1961, died on January 12 at the age of 82.

Mr. Schroeder's long-term collaboration with the late Dr. Henry Bryant Bigelow resulted in many important publications including one which is still on the MCZ's "best-seller list": *Fishes of the Gulf of Maine, Vols. I and II.*

Mr. Schroeder, who was also on the staff of Woods Hole for many years, was an avid collector of fishes. The introduction to *Fishes of the Western North Atlantic,* which was dedicated to Mr. Schroeder in 1972, includes this tribute: "It has been said of Bill Schroeder that he neither looks nor acts as if he were important. Cape Cod fishermen accepted him as an equal. And scientists name new species after him . . ."

Mrs. Myvanwy Dick of the Fish Department remembers him fondly as "a gentle, thoughtful man who had a superb knowledge of the fishes of the North Atlantic and a seemingly endless supply of patience for the many visitors to the Department."

William C. Schroeder, 1965.

MCZ newsletter
Harvard University. Museum of Comparative Zoology
MUS 4890.1a
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